

was taken not from a generic name (art. 23) but from a slightly different, Greek root of the latter part of names of the 4 original genera, all published simultaneously by the same author. This small family of 7 genera and about 22 species, all confined to Madagascar, was renamed Schizochlaenaceae by Barnhart (Bull. Torrey Bot. Club. 22: 17. 1895). The spelling Schizolaenaceae, also in use, is more appropriate, because the original form of the generic name was not *Schizochlaena* but *Schizolaena* Thouars (Hist. Végét. Iles Austr. Afrique 43, pl. 12. 1807), from the Latin root instead of the Greek root. The simplest course is to retain the original, conserved name Chlaenaceae. However, if the irregular derivation not from a generic name makes it an objectionable exception to art. 23, Chlaenaceae could be removed from the list of *nomina conservanda* in 1950 (art. 74).

Several small families, mostly containing only one or two small aberrant genera in each, have been added to the last editions of Engler's *Syllabus*. These family names, which were not checked, in general conform to present rules. The names

Crypteroniaceae and Sonneratiaceae, which were adopted by Dalla Torre and Harms (Gen. Siphon. 343. 1903) as well as by Diels (*in* Engler, Syllab. Pflanzenfam. ed. 11, 300. 1936), lose priority to older names taken from synonyms of the type genera. Though legitimate, Heteropyxidaceae and Julianaceae appear to be based upon generic names now rejected as later homonyms. Specialists working in all these groups should decide whether family names based upon the currently accepted names of the type genera should be conserved.

In the following case the family name based upon the accepted generic name has priority over that taken from a pre-Linnaean name of the type genus: Aesculaceae Lindl. (Introd. Nat. Syst. Bot. ed. 2, 84. 1836), from *Aesculus* L. (1753). Hippocastanaceae Torr. & Gray (Fl. No. Amer. 1: 250. 1838), from *Hippocastanum*. Both family names are widely used. However, Aesculaceae, is the proper name for the group, unless it is united with Sapindaceae, and does not require conservation.

PHYSIOLOGY.—*The endocrine glands and evolution, No. 2: The appearance of large amounts of cement on the teeth of horses.*¹ THEODORE E. WHITE, River Basin Surveys, Bureau of American Ethnology.

In 1942, in conjunction with the study of the horses of the Florida Miocene, I suggested that the folding of the enamel of the teeth might be correlated with the activities of the endocrine gland which stimulate and regulate metabolism and growth (White, 1942, p. 45). This concept has been further elaborated in a consideration of the deciduous teeth of *Hyracotherium* (in press). At the same time (1942, p. 44) I called attention to the fact that the deposition of cement on the teeth, in amounts to be functionally advantageous, necessitated a change in the animals' physiology. Also, I called attention (p. 44) to the coincidence of the geologically earliest appearance of large amounts of cement on the teeth occurring in an area in which the soil and water were excessively rich in calcium. Since the factual data on the quantity of cement on the teeth of the horses of the Florida Miocene have already been published, it is the purpose of this

study to examine the deposition of a large quantity of cement on the teeth in the light of the activities of the endocrine glands.

The science of endocrinology has advanced so rapidly within recent years and the literature on the subject is so voluminous that the more recent editions of standard textbooks inevitably will not be the last word on all aspects of the science. On the other hand, this delay will permit the confirmation or refutation of the newer findings and the textbooks will represent the consensus of opinion. Consequently, I have taken the statements of the activities of the glands from the more recent textbooks rather than to try to examine the original literature.

Since there are a number of excellent textbooks, each with an extensive bibliography, dealing with the activities and abnormalities of the endocrine glands, this subject will receive only the briefest treatment here. The function of the endocrine system is to maintain the orderly function of the organs, to stimulate and regulate

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growth and maturation in the young, and to regulate body temperature and metabolism. In general, the function of the system is to maintain a favorable "internal environment" or *homeostasis* (Goldzieher, 1939, p. 11).

The hormones themselves are *not* species specific. All vertebrates produce qualitatively the same hormones and respond to hormonal stimulation in the same manner (*ibid.*, p. 32). Most invertebrates and Protozoa show similar responses to some of the vertebrate hormones and a few of these have been identified in various groups (three from *Paramecium*).

No single gland acts independently but is closely integrated with the functions of the other glands of the system in order to maintain an endocrine balance. The distress resulting from an endocrine imbalance, such as Graves' disease, is a function of the degree and duration of the maladjustment and may terminate in death. The relationship between the various glands may be mutually synergistic as between the thyroid and pituitary, i.e., increased activity of the thyroid is accompanied by a decrease in the secretion of the thyrotropic hormone of the anterior lobe. Or, there may be reciprocal antagonism, as between the thyroid and adrenal cortex, i.e., increased activity of one is soon followed by a corresponding increase in the activity of the other (*ibid.*, p. 93).

In order to maintain homeostasis, the endocrine glands must respond to external factors. The changes in external environment which are accompanied by changes in the activities of the endocrine glands are altitude, temperature, climate, quantity and types of foods and accessory foodstuffs, such as mineral salts and vitamins. High temperatures cause diminished activity of the thyroid with increased iodine content, while the response to cold is increased activity. Although the incidence of Graves' disease has been correlated with geography and climate, there is reason to believe that in those cases where less than radical changes in external environment prove deleterious an endocrine imbalance already existed (*ibid.*, p. 11).

Minerals occur in the body fluids in two

forms: as organic compounds and as electrolytes. The proper balance of the latter is essential to health and is maintained by the diuretic action of several of the glands. An electrolyte imbalance affects certain glands depending on the mineral involved. An excess of the electrolytes of potassium inhibits the action of the adrenal cortex and increases the effectiveness of the thyroid hormone. A deficiency in calcium ions results in hyperactivity of the parathyroid (*ibid.*, p. 14).

Very little is known about the relationships of hormones and vitamins, although this has been extensively studied by many workers. Only vitamins A and D show toxic effects on unphysiologically large doses (*ibid.*, p. 17). Large doses of both vitamins A and C depress the metabolic rate of over-thyroidized animals (*ibid.*, p. 88). Vitamin D is essential for the normal absorption and utilization of the lime salts taken with food and in the ossification of the skeleton (Grollman, p. 253). On the other hand, overdosage appears to have a destructive effect on bone (Goldzieher, p. 19, and Shohl, p. 153).

Much remains to be learned concerning the heredity of the endocrine glands. In the case of endocrine deficiencies as well as hyperactivity (Grollman, p. 211) there is a distinct familial resemblance. However, in view of the responsiveness of the glands to external stimuli, this may be due to foetal environment. In some deficiencies, the state of the glands of the offspring show a particular resemblance to that of the mother (Goldzieher, p. 139). Stockard (1941), working with the genetics of dog breeds, attempted to change the offspring of a hypothyroid mother by administration of thyroid during the gestation period. From negative results he concluded that the genetic relationship was unalterable. On the other hand, he overlooked the fact that the female sex hormones of the pregnant mammal very effectively inactivate that of the thyroid (Goldzieher, p. 94). On theoretical grounds, the parent-offspring relationships of the endocrine glands should follow genetic laws but as yet confirmatory evidence is lacking.

Only four of the glands will be considered here: the pituitary, thyroid, parathyroid,

and the adrenal. The anterior lobe of the pituitary probably secretes a greater variety of hormones than any other one gland. Fourteen or more fractions of the anterior lobe have been isolated and tested (*ibid.*, p. 276). Half or more of these appear to be directed at a particular organ or gland and are classed as organotropic hormones. These include two gonadotropic, a thyrotropic, adrenotropic (cortex), and parathyrotropic principles. One each for the adrenal medulla, islands of Langerhans, and the spleen are suspected but not proved. In addition to the organotropic fractions, there are three special metabolic, a lactogenic, and a growth fraction (*ibid.*, p. 276). That the growth hormone is essential to growth has been demonstrated by hypophysectomy of laboratory animals, in which no growth occurred without the administration of the hormone despite an optimum diet. The administration of the hormone to normal animals has produced giant rats, but with dogs, deformities similar to acromegaly occurred (Grollman, p. 44). The thyroid hormone is also essential for growth, but is not a substitute for that of the anterior lobe (Goldzieher, p. 279). Experiments indicate that the internal secretions of the gonads are antagonistic to the growth promoting hormone. The antagonism is greater in the males than the females (*ibid.*, p. 278).

As far as is known, the thyroid secretes a single hormone, thyroxin, but its effects on the body are multiple. These effects can be divided into three major categories: metabolic, morphogenic, and general effects. The metabolic changes which accompany an increase in the activity of the thyroid are: increased oxidation, calorigenesis above certain body temperatures, diuresis, protein and fat metabolism, and calcium-phosphorus exchange. There is a corresponding decrease in these activities with a decrease in the activity of the thyroid. The increased excretion of calcium and phosphorus due to hyperthyroidism may have osteoclastic effects and lead to demineralization of the skeleton (*ibid.*, p. 82). On the other hand, the increase in calcium-phosphorus exchange is not proportional to the increased metabolic rate, and if the diet is adequate, there is no evi-

dence of failure of ossification in the young or decalcification in the adult in rats rendered severely hyperthyroid (Grollman, p. 175).

The dominant role in morphogenesis is played by the thyroid not only in the young and growing animal but in the adult as well. In tadpoles the administration of thyroid speeds up metamorphosis, and the growth and differentiation of the internal organs. However, large unphysiological doses impair growth and dwarfed animals result (Goldzieher, p. 83). That the thyroid is essential to the ossification of bone and formation of teeth is shown by the rapidity with which the abnormalities of these parts, due to thyroid insufficiency, are corrected in the young and growing animal by the administration of the hormone. The healing of fractures and cuts is speeded up by the administration of thyroid. The characteristics of the skin, hair, and nails accompanying hypothyroidism disappear with hormone medication.

The general effects of medication or increased thyroid activity include: increased irritability of nervous system with decreased reaction time, accelerated cardiac action and vasodilatation, increased peristaltic action, and increased tonus of striated muscle (*ibid.*, p. 84).

Because of their small size, the parathyroids were not discovered until relatively recently. Once their relation to certain skeletal anomalies was recognized, they began to receive attention from many workers. Their function appears to be the mobilization or retention, respectively, of electrolytes and water (*ibid.*, p. 210). In regard to water mobilization, there is a synergistic action between the parathyroid, thyroid, and anterior lobe of the pituitary while the antagonistic action, i.e., retention of water, is produced by the posterior lobe, adrenal cortex, and the pancreatic islands. The mobilization of electrolytes do not appear to be so strikingly grouped, or rather the state of knowledge does not permit such a grouping. However, there is a definite synergism between the parathyroid and thyroid in regard to calcium metabolism and a reciprocal antagonism between the parathyroid and adrenal cortex in regard to sodium.

The relationship between vitamin D and

the parathyroid is complex and requires further study. Both are essential to the ossification of the skeleton (Grollman, p. 253), but neither is a substitute for the other (Goldzieher, p. 223). They are synergistic in maintaining the level of the serum calcium but are antagonistic as regards serum phosphorus. Vitamin D causes assimilation of calcium from the digestive tract and deposition in the bone while the parathyroid extracts calcium from the bone in a low calcium diet (Grollman, p. 286, and Goldzieher, p. 19).

The limits of variation in the function of the parathyroid, without harmful results, appear to be much narrower than those of the other glands. In laboratory animals there is considerable variation in the responses to parathyroidectomy. In the Carnivora, with a high intake of phosphorus, tetanic convulsions develop in a few days on an uncontrolled diet and death soon results (Goldzieher, p. 206). However, on a diet rich in calcium, they can be kept alive much longer (Grollman, p. 252). In the herbivorous animals, whose diet is rich in calcium, acute tetanic symptoms usually do not occur, but after a month there is a deterioration of the incisor teeth of the rat (*ibid.*, p. 251).

The manifestation of natural parathyroid insufficiency is characterized by the following metabolic changes: decrease in serum calcium, increase in serum phosphorus, and decrease in elimination of both calcium and phosphorus in the urine (Goldzieher, p. 219). The deleterious results of these changes can be postponed by a diet high in calcium and low in phosphorus (*ibid.*, p. 222, and Grollman, p. 267). Without a rigidly controlled diet, vitamin D would appear to aggravate the symptoms (Goldzieher, p. 223). Other manifestations of parathyroid insufficiency are: brittleness and decay of the teeth, brittleness of the nails, loss of hair, and the formation of cataracts in the eye (*ibid.*, p. 218, and Grollman, p. 263).

The manifestation of hyperparathyroidism is characterized by increased water and calcium-phosphorus metabolism which bring about the following skeletal changes: general demineralization, fractures or other deformi-

ties, and giant cell tumors or bone cysts (Goldzieher, p. 227). The metabolic changes are accompanied by an increase in the serum calcium and a decrease in the serum phosphorus (Grollman, p. 282). The principal source of the calcium in hyperparathyroidism is the bone, but a high calcium diet may be of aid in preventing decalcification (*ibid.*, p. 283).

The administration of parathyroid extract to normal laboratory animals permits the following generalizations (*ibid.*, p. 258): large doses exert an osteoclastic effect, and induce stunting of growth and resorption of bone. Moderate doses cause softening of bone with disappearance of the trabeculae and an increase of osteoclasts. Small doses have an osteoblastic effect and produce hard and sclerotic bone.

The adrenal is a bipartite gland consisting of medullary and cortical portions. As yet no function has been clearly demonstrated for the adrenal medulla, and mammals appear to suffer no ill effects on being deprived of its hormone, epinephrine (*ibid.*, p. 408). On the other hand, that the cortex is essential to life is shown by the short survival period following bilateral adrenalectomy (*ibid.*, p. 388). There is no evidence of effects from overdosage of cortical extract except to suppress the activity of the animals adrenals (*ibid.*, p. 397). On the other hand, large doses of the extract increase weight and reduce oxygen consumption in Grave's disease, or in experimental hyperthyroidism (Goldzieher, p. 622). That the cortical hormone is antagonistic toward the thyrotropic hormone of the anterior lobe of the pituitary is shown by the fact that the simultaneous administration of the two hormones does not result in increased metabolism despite typical histological changes in the thyroid (*ibid.*, p. 93).

Cortical insufficiency is accompanied by diminished activity of the pituitary, thyroid, sex glands, and possibly also the pancreas and parathyroid (Grollman, pp. 401-402) and many of these reactions appear to be reciprocal (Goldzieher, pp. 621-624). Also cortical insufficiency leads to greater susceptibility to infections and toxins (Grollman, p. 391). In general, it can be said that

disabilities of nearly all organs of the body result from cortical insufficiency and the degree of disability is proportional to the degree of insufficiency. The effects of the cortical hormone on general health fall very little short of those of the thyroid and anterior lobe of the pituitary.

Although certain aspects of mineral metabolism were mentioned in connection with the several glands, the role of calcium and phosphorus merits a brief review. These two minerals are the principal ingredients of bone and both are essential for the formation of strong healthy teeth. In the presence of vitamin D probably all, except a very small fraction, of these minerals ingested are assimilated, principally in the small intestine (Shohl, p. 84). The body retains the amount it needs and the remainder is excreted chiefly through the large intestine (Grollman, p. 253). The absorption into, and the removal from, the blood of these minerals takes place simultaneously without any great changes in their concentration in that medium (Shohl, p. 143). In general, the concentration of both calcium and phosphorus in the blood is greater in the young and growing animal than the adult, but the limits within which they can vary without disastrous results are very narrow (*ibid.*, p. 110). The factors which control the level of calcium and phosphorus in the blood are: the thyroid, parathyroid, and vitamin D. Increased activity of the thyroid results in increased excretion of both minerals through the large intestine and decreased activity has the opposite effect (Grollman, p. 175). Increased activity of the parathyroid raises the level of the blood calcium and results in an increased excretion of both calcium and phosphorus through the kidneys (*ibid.*, p. 286). Vitamin D causes increased assimilation of both minerals and diverts them to the skeleton (*ibid.*).

Also the ingestion of soluble salts of calcium raises the blood level slightly, which subsides after a few hours. This rise is usually, but not always, followed by a rise in the serum phosphorus. The lag between the two is about 4 hours (Shohl, p. 134).

Of perhaps greater importance than maintaining the concentration of these

minerals in the blood is the maintenance of a relatively constant ratio between them (*ibid.*, p. 348). On a low calcium-phosphorus intake, if either mineral is low with respect to the other for any period of time rickets result. On a non-rachitic diet a low calcium balance results in increased activity of the parathyroid. Low calcium rickets is accompanied by increased activity of the parathyroid but it remains unaffected by low phosphorus rickets (Grollman, p. 286). The role of vitamin D in maintaining the calcium-phosphorus ratio is not well understood. But, if either is low with respect to the other, the administration of the vitamin tends to alter the relationship toward normal (Shohl, p. 134).

The retention of minerals in the body is subject to fluctuations at all ages. In general, the amount retained decreases with age, but there seems to be no reason to believe it ever reaches zero. Experiments in the feeding of infants show that increased retention with high intakes are obtained, not only with natural foodstuffs, but also when minerals are further increased by the addition of inorganic salts (*ibid.*, p. 329). Also, without altering the food intake the retention was higher with the administration of vitamin D (*ibid.*). In general, it can be said that the absolute amounts of calcium and phosphorus retentions are roughly in proportion to the intakes, for only when the intake is extremely low or extremely high is there any alteration of the percentage of the intake retained, at any given age (*ibid.*, p. 351).

The chemical composition of bone has received consideration from many workers. It is a complex mineral molecule of which tricalcium phosphate forms the principal part (*ibid.*, p. 32). Its mineral composition is nearly, but not quite, constant (*ibid.*, p. 141). Bone is not an inert concretion but is a vascular structure and the minerals may be readily transferred to the blood (*ibid.*, p. 140, and Grollman, p. 253). The deposition of calcium phosphate to form bone is dependent on the amount and proportion of the ingested calcium and phosphorus, the parathyroid hormone, vitamins C and D, and the presence of the enzyme, phosphatase, at the site of deposition (Shohl,

pp. 142-143). In view of the delayed ossification resulting from insufficiencies of the thyroid and growth hormones, it would appear that these hormones were also essential to bone formation, but it may be only an expression of their general metabolic effects. Administration of the female sex hormone, estradiol, increases the density of bone in laboratory animals but its effects are not yet well understood (*ibid.*, p. 115).

Magnesium has been shown to prevent calcification *in vitro* (*ibid.*, p. 142), but with less than excessive doses laboratory animals show no ill effects if the calcium-phosphorus intake is adequate. A high magnesium and a low calcium-phosphorus diet produces rickets in young and growing animals (*ibid.*, p. 165).

The factors governing the formation of strong healthy teeth are not well understood and many controversial claims have been made. But it appears that an adequate intake of both calcium and phosphorus is essential, as well as sufficient vitamins C and D (*ibid.*, p. 145). That the thyroid and parathyroid hormones are also essential are indicated by the tooth defects which accompany insufficiencies of these glands. Recent studies show that the teeth, especially the dentine and cement, cannot be considered inert structures but are subject to the same changes which occur in the bones (*ibid.*, pp. 145, 341).

Under the name *metastatic calcification* are grouped those depositions of calcium and phosphorus in other than the normal areas of deposition. Their mineral composition is similar to, but not identical with, that of bone (*ibid.*, p. 153). The commonest sites of occurrence are the kidneys, stomach, lungs, and arteries, and include the tissues from which the chief secretions of acid take place. Also they include the tissues, aside from the bones, in which occur the highest concentrations of phosphatase (*ibid.*, p. 142). This condition has been induced experimentally by a high calcium intake, high phosphorus intake, and by the administration of an excess of vitamin D or parathyroid hormone (*ibid.*, p. 154).

A rare and little understood variation of this condition is known as *calcinosis universalis* in which the deposits are subcutaneous

instead of in the other organs (*ibid.*, p. 154). There is a high retention of both calcium and phosphorus whether the intake is high or low, and does not appear to be correlated with the activities of the parathyroid or thyroid glands, or with calcium or vitamin D effects. Perhaps when this condition is better understood, the derivation of the armadillos, turtles, scincosaurs, and armored teleosts will be much clearer.

The environment for herbivorous mammals furnished by Florida during Lower Miocene time has already been published (White, 1942, pp. 42-44). Briefly, it may be summarized as a very favorable, if not optimum, environment; an area with a subtropical climate, probably an open, grassy woodland, populated by plants which had a high tolerance for an excess of calcium in the soil. Also, any streams (drinking water for the mammals) would be highly charged with calcium. Consequently, the herbivorous mammals inhabiting the area would be subjected to a daily high calcium intake.

Since the eruption of the permanent teeth of horses is concurrent with gonadal maturation, though the former is of longer duration, their form must necessarily have been previously determined by the growth of the dental germ. In the period prior to the onset of, and during, puberty large amounts of estrogens, androgens, and adrenal cortex hormone are discharged into the blood. These hormones have an inhibitory effect on the thyrotropic hormone of the anterior lobe of the pituitary (Goldzieher, pp. 83, 289) resulting in a decrease in the activity of the thyroid. Some cases of mild hypothyroidism do not exhibit a pathological condition of the thyroid until the onset of puberty (*ibid.*, p. 139). The decreased activity of the thyroid results in the decreased elimination of calcium and phosphorus through the large intestine and an increased deposition in the bone (*ibid.*, p. 82). Since the function of the parathyroid is not necessarily affected by the state of the thyroid (*ibid.*, p. 210), no compensatory increased activity on its part can be postulated. In young and growing animals, with an abundance of vitamin D, the retention of calcium and phosphorus is notably higher than in

the adult. Also, vitamin D regulates the level of these minerals in the blood by diverting them to the skeleton where they are deposited (Grollman, p. 286). Since the cement depositing cells of the tooth sac are active at this time, it is reasonable to conclude that they, like the osteoblasts, would respond to the stimulus of vitamin D to help maintain the level and ratio of these minerals in the body fluids. Consequently, it would appear that *the deposition of a large amount of cement on the teeth of the Florida Miocene horses was the result of a high mineral intake and a temporary endocrine imbalance brought on by the maturation of the gonads.* Also, the amount of cement de-

posited would be a function of the degree of endocrine imbalance.

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ZOOLOGY.—*Marine Ostracoda from Tortugas, Florida.*¹ WILLIS L. TRESSLER, University of Maryland. (Communicated by WALDO L. SCHMITT.)

The marine ostracods of the eastern North American coast are still imperfectly known. Brady and Norman (1889) reported on ostracods of the North Atlantic, and a few years before this, Dr. Brady (1870) described a few from the Gulf of St. Lawrence. Cushman (1906) reported on 26 species from Vineyard Sound and Woods Hole. Blake (1929, 1933) added considerably to our knowledge of American marine Ostracoda in his report on the ostracods of the Mount Desert region. Tressler (1940) listed eight species from the sand beaches at Beaufort, N. C., and Tressler and Smith (1948) made an ecological study of the ostracods of the Solomons Island, Md., region.

The present paper deals with 13 species of marine ostracods, 7 of which are believed to be new, from the Dry Tortugas, Fla. The material was largely obtained by Dr. Waldo L. Schmitt, U. S. National Museum, from debris secured in the course of otter trawl hauls and from the cracking up of corals and rocks, seaweed washings, and rock scrapings. Only two species were otherwise collected; these were from the alimentary tracts of fish dissected by Dr. Harold W. Manter, of the University of Nebraska. The

distribution of the species in the Tortugas area is shown in Table 1.

The slides of the dissected and figured specimens, together with the alcoholic material, have been deposited in the U. S. National Museum as type specimens.

Suborder MYODOCOPA

Family CYPRIDINIDAE

Subfamily CYPRIDININAE

Genus *Cypridina* Milne-Edwards

Valves moderately tumid of more or less oval shape with smooth surface. Frontal incisure deep and occurring nearly in the middle of the anterior border. Eye well developed in both sexes, but larger in the male. Frontal tentacle short, clavate. Anterior antenna 7-articulate and similar in both sexes. In most cases the posterior antenna has an endopodite that is not transformed in the male. Furca with at most 12 claws.

Cypridina squamosa G. W. Müller

Fig. 21

Cypridina squamosa G. W. Müller, F. Fl. Neapel **21**: 207. 1894.

Specific characters.—FEMALE: Shell rather short, height about two-thirds the length and higher in the posterior half. Dorsal margin of valve strongly rounded, ventral border less so.

¹A contribution from the Zoology Department, University of Maryland, College Park, and the Chesapeake Biological Laboratory, Solomons, Md. Received May 5, 1949.